WHAT IS CLAIMED IS:

1. A method of forming an optical waveguide on an undercladding layer of a substrate, the method comprising:

forming at least one silicate glass optical core on said undercladding layer using a high-density plasma deposition process including a silicon source gas and an oxygen source gas;

wherein the refractive index of the undercladding layer is less than the refractive index of the optical core.

2. The method of claim 1 wherein the high-density plasma process comprises pressure of less than 100 millitorr and an RF energy greater than 3 $Watts/cm^2$.

3. The method of claim 2 wherein the high-density plasma process further comprises a nitrogen source gas and the optical core comprises silicon, oxygen, and nitrogen.

4. The method of claim 3 wherein the nitrogen source gas is molecular nitrogen.

5. The method of claim 3 wherein the optical core is an SiON optical core.

6. The method of claim 3 wherein the ratio of oxygen atoms to silicon atoms is greater than 3:1.

7. The method of claim 3 wherein the silicon source comprises silane, the oxygen source comprises molecular oxygen, and the nitrogen source comprises molecular nitrogen.

8. The method of claim 7 wherein the ratio of molecular oxygen to silane is greater than 1.5:1.

9. The method of claim 7 wherein the oxygen source flow is between 200-600 sccm.

10. The method of claim 7 wherein the ratio of molecular nitrogen to silane is between 0.5 and 5.0.

11. The method of claim 7 wherein the nitrogen source flow is between 300-500 sccm.

12. The method of claim 1 wherein the high-density plasma process is carried out at a temperature of greater than 600°C.

13. The method of claim 1 wherein the optical core comprises a phosphorus doped silicate glass or germanium doped silicate glass.

14. The method of claim 1 wherein the contrast between the refractive index of the core and the refractive index of the undercladding layer is greater than 2%.

15. The method of claim 1 wherein forming at least one optical core comprises:

depositing a continuous optical core layer using said high-density plasma deposition process; and

etching the continuous optical core layer to form the at least one optical core.

16. The method of claim 15 wherein the depositing using said high-density plasma deposition process does not use an RF bias.

17. The method of claim 1 wherein forming at least one optical core comprises:

etching at least one trench in the undercladding layer;

depositing the at least one optical core in the corresponding at least one trench using said high-density plasma deposition process; and

depositing an uppercladding layer over the at least one optical core.

18. The method of claim 17 wherein the depositing using said high-density plasma deposition process does includes an RF bias.

19. The method of claim 1 wherein said high-density plasma deposition process is a high-density plasma electron-cyclotron resonance process.

20. The method of claim 1 wherein said high-density plasma deposition process is a high-density plasma chemical vapor deposition process.

21. The method of claim 1 further comprising annealing the at least one optical core after the high-density plasma deposition process.

22. A method of depositing an optical core on a substrate in a processing chamber comprising:

establishing a pressure of less than 100 millitorr in said processing chamber;

generating an RF power density of greater than 3 Watts/cm^2; and

providing a silicon source gas, an oxygen source gas, and a dopant source gas in said processing chamber, wherein the dopant source gas increases the refractive index of said optical core above 1.46.

23. The method of claim 22 wherein the ratio of oxygen atoms to silicon atoms is greater than 3:1.

24. The method of claim 22 wherein the dopant source gas is a nitrogen source gas and the optical core comprises silicon, oxygen, and nitrogen.

25. The method of claim 24 wherein said nitrogen source gas is molecular nitrogen.

26. The method of claim 25 wherein the silicon source gas is silane.

27. The method of claim 26 wherein the ratio of molecular nitrogen to silane is between 0.5 and 5.0.

28. The method of claim 22 wherein the dopant source gas is a phosphorus containing gas or germanium containing gas.

29. A substrate processing system comprising:

a housing defining a process chamber;

a high-density plasma generating system operatively coupled to the process chamber;

a substrate holder configured to hold a substrate during substrate processing;

a gas-delivery system configured to introduce gases into the process chamber, including sources for a silicon-containing gas, an oxygen-containing gas, and a dopant-containing gas;

a pressure-control system for maintaining a selected pressure within the process chamber;

a controller for controlling the high-density plasma generating system, the gas-delivery system, and the pressure-control system; and

a memory coupled to the controller, the memory comprising a computer-readable medium having a computer-readable program embodied therein for directing operation of the substrate processing system to form an optical core a substrate, the computer-readable program including

instructions to flow a gaseous mixture containing flows of the silicon-containing gas, the oxygen-containing gas, and the dopant-containing gas;

instructions to maintain a pressure of less than 100 millitorr within the process chamber; and

instructions to provide an RF power density greater than 3 Watts/ cm^2 into the process chamber, and in accordance therewith, generate a high-density plasma from the gaseous mixture and deposit a doped silicate glass optical core, wherein the dopant-containing gas increases the refractive index of said optical core above 1.46.

30 . The substrate processing system of claim 29 wherein the ratio of oxygen atoms to silicon atoms is greater than 3:1.

31. The substrate processing system of claim 29 wherein the dopant-containing gas comprises a nitrogen-containing gas and the optical core comprises silicon, oxygen, and nitrogen.

32. The substrate processing system of claim 31 wherein the silicon-containing comprises silane and the nitrogen-containing gas includes molecular nitrogen.

33. The substrate processing system of claim 32 wherein the ratio of molecular nitrogen to silane is between 0.5 and 5.0.

34. The substrate processing system of claim 29 wherein the substrate holder comprises an electrostatic chuck, and wherein computer-readable program further includes instructions for turning electrostatic chuck off during deposition of the silicate glass optical core.

35. The substrate processing system of claim 29 further comprising a top RF source and a side RF source, wherein the ratio of power of the top RF source to the side RF source is between 0.21 and 0.73.

36. The substrate processing system of claim 29 wherein the dopant containing gas is a phosphorus containing gas or germanium containing gas.

37. A computer-readable storage medium having a computer-readable program embodied therein for directing operation of a substrate processing system including a process chamber; a plasma generation system; and a gas delivery system configured to introduce gases into the process chamber, the computer-readable program including instructions for operating the substrate processing system to form an optical core on a substrate disposed in the processing chamber in accordance with the following:

establishing a pressure of less than 100 millitorr in said processing chamber;

generating an RF power density of greater than 3 Watts/cm^2; and

providing a silicon source gas, an oxygen source gas, and a dopant source gas in said processing chamber, wherein the dopant source gas increases the refractive index of said optical core above 1.46.

38. The computer-readable storage medium of claim 37 wherein the ratio of oxygen atoms to silicon atoms is greater than 3:1.

39. The computer-readable storage medium of claim 37 wherein the dopant source gas is a nitrogen source gas and the optical core comprises silicon, oxygen, and nitrogen.

40. The computer-readable storage medium of claim 39 wherein said nitrogen source gas is molecular nitrogen and the silicon source is silane.

41. The computer-readable storage medium of claim 40 wherein the ratio of molecular nitrogen to silane is between 0.5 and 5.0.

42. The computer-readable storage medium of claim 37 wherein the dopant source gas is a phosphorus containing gas or germanium containing gas.